type, and most collections so named in herbaria represent an actinomorphic-flowered plant with drooping, 1-3-flowered spikes and long slender capsules. However, the few collections of plants with straight spikes, often with 3-6 flowers and short capsules represent another species, here named *G. perrieri*. Live material and photographs show that it has zygomorphic flowers, the lower tepals of which often have purple nectar guides.

The last Madagascan *Gladiolus, G. garnieri*, however, is not closely related to the above seven species, but to a complex of large-flowered African species. Moreover, it can barely be distinguished, if at all, from the polymorphic tropical African *G. dalenii* and it seems best to include it in the latter.

NOTABLE FEATURES OF MADAGASCAN *GLADIOLUS* AND A HYPOTHETICAL PHYLOGENY

Gladiolus is a member of the Old World and predominantly African subfamily *Ixioideae* which is defined by a basal rooting corm and sessile flowers subtended by a pair of opposed bracts and usually arranged in a spike (GOLDBLATT, 1979). The flowers of *Ixioideae* have a well-developed perianth tube, are frequently medianly zygomorphic, and have septal nectaries. Within the subfamily, *Gladiolus* is distinguished from related genera by a secund spike, large herbaceous bracts, simple style branches with terminally expanded apices, inflated, coriaceous capsules and seeds with a broad circumferential wing. The genus comprises over 180 species, but despite its size, the species do not fall into easily defined groupings. Four informal groups based on the number of foliage leaves were recognized by LEWIS et al. in a revision of the genus in southern Africa (LEWIS et al., 1972), the centre of diversity for *Gladiolus* and where more than half the species occur. In this artificial system, the Madagascan species fall in the *Paucifoliatae*, having 2-5 foliage leaves. Except for *G. dalenii*, which occurs throughout tropical Africa, and belongs to a complex of species with similar large flowers, the Madagascan species appear to comprise a monophyletic lineage, and have no readily identifiable relatives in Africa. They have relatively small flowers and a yellow perianth, a colour that is unusual in the genus. The fibrous and reticulate nature of the corm tunics, shared by all the yellow-flowered species except *G. luteus*, is probably a specialized feature. Most species of *Gladiolus* have membranous to coriaceous tunics. A hypothetical phylogeny of *Gladiolus* in Madagascar is presented in the form of a cladogram (Fig. 1) which was constructed manually after methods outlined by WILEY (1981). Characters used in the cladogram are listed in Table 1, in which the following discussion is summarized. Polarization of primitive (plesiomorphic) and derived (apomorphic) states was determined by outgroup comparison (WILEY, 1981) with other species of *Gladiolus* and by using widely accepted trends of specialization in *Iridaceae*.

Unusually large or small features are considered specialized from an intermediate state. The seven yellow-flowered endemic Madagascan species of *Gladiolus* appear to be united by their specialized yellow flower colour and fibrous corm tunics. They form of a well-defined lineage in *Gladiolus* within which the unusually small capsules, generally less than 14 mm long, of *G. decaryi, G. antandroyi, G. bojeri, G. perrieri* and *G. horombensis* appear to separate these species as a clade. The particularly long perianth tubes of the two former species suggest that they are an allied species pair. The tiny flowers of *G. perrieri* and *G. bojeri* with tepals 10-15 mm long represent a specialization uniting these two slender and easily confused species.

TABLE 1 : Characters used in the cladogram (Fig. 1) with the derived (apomorphic) condition listed first followed by the presumed ancestral (plesiomorphic) condition.

1. corm tunics fibrous — corm tunics firm-membranous to subfibrous
2. corm tunics more or less corky — corm tunics fibrous
3. flowers yellow — flowers blue-purple
4. capsules small, usually less than 14 mm long — capsules large, usually at least 14 mm long
5. capsules slender and elongate — capsules small
6. bracts large, usually exceeding 20 mm — bracts moderate to small, less than 20 mm long
7. bracts small (less than 12 mm long) — bracts of moderate size (12-20 mm long)
8. flowers small (tepals less than 15 mm long) — flowers of average size (tepals more than 16 mm long)
9. flowers few (usually less than 6 per spike) — flowers usually more than 5 per spike
10. spike drooping — spike erect
11. perianth tube at least as long as the bracts — tube much shorter than the bracts
12. perianth tube much exceeding the bracts — tube shortly exceeding the bracts
13. upper tepal erect — upper tepal hooded
14. tepals ± clawed (narrow at base) — tepals not clawed
15. flower actinomorphic — flower zygomorphic
16. numerous cormlets produced — few or no cormlets produced

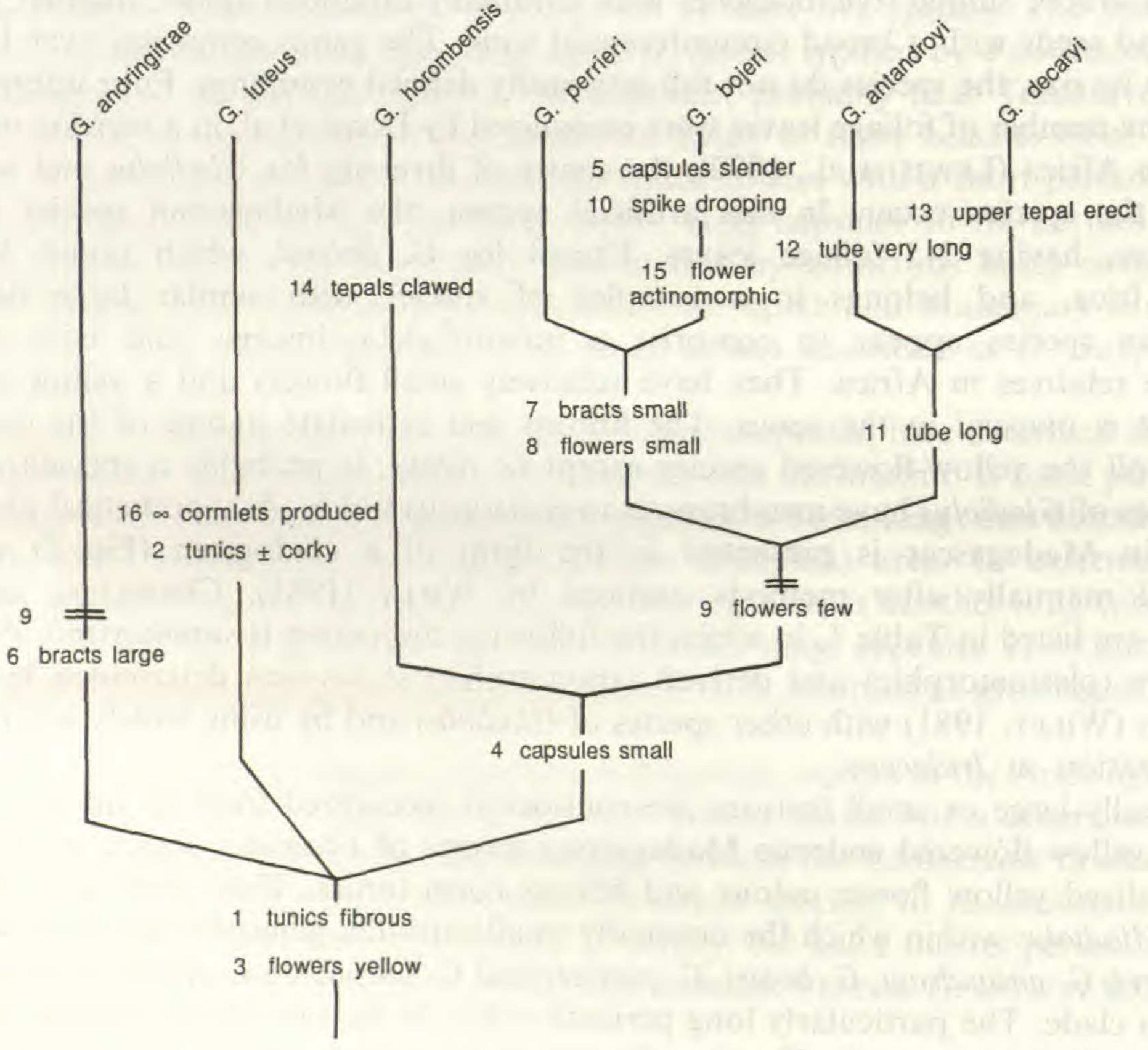


Fig. 1. — Cladogram of the yellow-flowered Madagascan species of **Gladiolus** based on the characters listed in Table 1.

The unique elongated capsules of *G. bojeri*, its actinomorphic flower, and drooping spike are clearly specialized features for this very distinct species. *Gladiolus luteus* should probably considered specialized in its coriaceous, almost corky corm tunics and the production of numerous cormlets with thick corky tunics, presumably adapted for water dispersal (see discussion under the species). A major apomorphic character in *G. andringitrae* appears to be its long leafy bracts while *G. horombensis* has specialized, more or less clawed tepals, so narrow at the base that the perianth is windowed in side view. A somewhat weak and variable character, a spike of few flowers (usually less than 5 except in robust individuals), unites four species in one clade (Fig. 1). This character also occurs in *G. andringitrae* where I consider it convergent.

CHROMOSOME CYTOLOGY

Chromosome number was established for six Madagascan species of *Gladiolus*. Counts were obtained from mitosis in root tips of germinating seeds. The cytological methods employed are described elsewhere (GOLDBLATT, 1979). *Gladiolus luteus*, *G. andringitrae* and *G. horobensis* have $2n = 30$, a number matching the basic diploid number for the genus (GOLDBLATT, 1971) while *G. decaryi* has $2n = 30 + 0\text{-}2B$. *Gladiolus bojeri* also has $2n = 30$, further confirming its transfer from *Geissorhiza* (GOLDBLATT, 1982), the base number of which is $x = 13$. Three separate populations of *G. dalenii* also have $2n = 30$, and in Madagascar the species is evidently diploid in contrast to tropical and southern Africa where it is polyploid with $2n = 60$ and 90. The Madagascan species of *Gladiolus* thus correspond cytologically with the rest of the genus.

SYSTEMATICS

KEY TO THE SPECIES

1. Perianth large, orange to red with yellow markings on the lower tepals (sometimes entirely yellow); upper tepal largest, 30-45 cm long and hooded ..... 8. *G. dalenii*

1′. Flowers medium to small, shades of cream to yellow, occ. flushed or marked purple, red or pink on the lower tepals; upper tepal prominent, 8-22 mm long, either longer or shorter than the lower, hooded or erect, or flower actinomorphic with equal tepals.

2. Flowers with a perianth tube less than 10 mm long, emerging between the bracts.

3. Tepals 12-22 mm long; bracts 12-40 mm long.

4. Corms with many basal cormlets; tunics red-brown, membranous; occurring along the east coast on the sea shore ..... 2. *G. luteus*

4′. Corms with 0-2 basal cormlets; tunic fibrous and reticulate; occurring in the south-central interior.

5. Bracts 12-18(-22) mm long; capsules 7-12(-20) mm long ..... 3. *G. horombensis*

5′. Bracts (20-)25-40 mm long; capsules 14-17 mm long ..... 1. *G. andringitrae*

3′. Tepals 8-12(-14) mm long; bracts 8-10(-12) mm long.

6. Perianth actinomorphic, drooping at anthesis; capsules ± cylindrical, 12-20 mm long. ..... 7. *G. bojeri*

6′. Perianth zygomorphic, facing to the side at anthesis; capsules ovoid, 8-10 mm long. ..... 6. *G. perrieri*

2′. Flowers with the perianth tube 15-30 mm long, erect and reaching or exceeding the apex of the bracts.

7. Tube 20-30 mm long; capsules 11-14 mm long; bracts green or flushed brownish above. ..... 5. *G. antandroyi*

7′. Tube 14-20 mm long; capsules 5-9 mm long; bracts reddish-brown and membranous at least above ..... 4. *G. decaryi*

1. **Gladiolus andringitrae** Goldbl., *sp. nov.* — Fig. 2, *1*.

Plantae 15-25 cm altae, tunicis cormi fibrosis, foliis 4-6, spicis 3-6 florum, bracteis (20-)25-35(-40) mm longis, floribus luteis, tubo perianthii ca. 8 mm longo, tepalis inaequalibus, 18-20 mm longis, capsulis 14-17 mm longis.

TYPE : *Perrier 14483*, Madagascar, Fianarantsoa, Massif d'Andringitra, 2000-2400 m, 2.1922 (holo-, P ; iso-, P).

Plants 15-25 cm high. *Corms* 8-10 mm in diam., tunics of pale straw-coloured, reticulate fibres. *Leaves* 4-5(-6), at least the lower 3 basal, linear to narrowly lanceolate, 2-4 mm wide, about as long as the spike, upper leaves inserted on the stem, shorter than the lower. *Stem* unbranched. *Spike* 3-6 flowered ; *bracts* herbaceous, (20-)25-35(-40) mm long, the inner 3-10 mm shorter than the outer. *Flowers* lemon yellow, the lower lateral tepals each with small red-brown marginal markings near the base ; *perianth tube* ca. 8 mm long, the apex exserted from the lower half of the bracts ; *tepals* 18-20 mm long, unequal, the upper widest and arching over the stamens, the upper lateral tepals flaring outwards from just above the base, the lower three tepals longer than the uppermost by 3-5 mm, directed downwards at 45°, narrowed below into claws. *Filaments* 6-7 mm long, inserted at the base of the wider upper part of the tube, reaching to the mouth of the tube, unilateral and arcuate ; *anthers* 3.8-4 mm long, pale red-brown. *Ovary* ca. 4 mm long, style arched over the stamens, dividing near mid-anther level, branches ca. 2 mm long. *Capsule* 14-17 mm long, ellipsoid ; *seeds* including the wing 5-6 × 2.5-3.5 mm, yellow-brown. *Chromosome number* $2n = 30$.

Flowering time : February to April.

DIAGNOSIS AND RELATIONSHIPS : Perhaps most easily confused with the east coast strand species, *Gladiolus luteus*, which has similar flowers and comparably large capsules, *G. andringitrae* can be distinguished by a consistently unbranched stem, unusually long floral bracts, 20-40 mm long, and particularly by its small corms with fibrous reticulate tunics and without the many small basal cormlets so characteristic of *G. luteus*.

DISTRIBUTION AND HABITAT : Known only from the Andringitra Massif of southeastern Madagascar (Fig. 3, *1*), *Gladiolus andringitrae* is apparently restricted to high elevations. It has been recorded from rocky situations between 2000 and 2400 m, including Boby, the highest peak in the range.

MATERIAL EXAMINED. — MADAGASCAR : Fianarantsoa : *Goldblatt & Schatz 8974*, Andringitra, path to Pic Boby, on rock outcrops near the base of the main cliffs, 3.1989, fl. & fr. (MO, TAN) ; *Homolle 1189*, Pic Boby (Massif d'Andringitra), 20.3. (P) ; *Perrier 13655*, Andringitra, 2400 m, 4.1921 (P) ; *14483*, Massif d'Andringitra, 2000-2400 m, 2.1922 (P).

2. **Gladiolus luteus** Lamarck. — Fig. 2, *2*.

Encycl. 2 : 725 (1788) ; PERRIER, Flore de Madagascar, 45e fam., Iridacées : 16-17 (1946), *pro parte* ; MARAIS, Flore Mascareignes, fam. 177 : 12-14 (1978).

— *Gladiolus frappieri* J. HERM. ex DE CORDEMOY, Flore Réunion : 162 (1895). TYPE : La Réunion, St. Joseph (holo-, MARS-Herb. Cordemoy, not seen).

— *Gladiolus arenarius* THOUARS *mss.*

TYPE : *Commerson s.n.*, Madagascar, without precise locality (holo-, P-JU).

Fig. 2. — Morphology of **Gladiolus andringitrae** (1) and **G. luteus** (2). Habits, fruiting spike and corms × 0.5; single flower of **G. andringitrae** × 2; seeds × 1. (Del. J. C. MANNING).

Plants (12-)20-45 cm high. *Corms* 10-15 mm in diam. with several to many basal cormlets 5-7 mm long, 3 mm wide, tunics red-brown, membranous, breaking irregularly, the cormlets with somewhat corky rugose tunics. *Leaves* about 5, lower basal, the upper 1-2 cauline, the lowermost longest and slightly exceeding the stem, the upper progressively shorter, narrowly lanceolate to linear, 2-4 mm wide, margins and midrib distinct, hyaline. *Stem* more or less erect, sometimes with 1 short branch. *Spike* 5-9 flowered; *bracts* 12-18 mm long, herbaceous, inner 3-4 mm shorter than the outer. *Flower* yellow; *perianth tube* 5-7 mm long, emerging below the apex of the bracts; *tepals* lanceolate, unequal, upper 12-15 mm long, to 7 mm wide, hooded and arching over the stamens, lower tepals extending horizontally, 14-18 mm long.

Filaments unilateral and arching under the upper tepal; *anthers* 5-7 mm long. *Ovary* globose, ca. 2.5 mm long, style arched above the filaments, dividing near the anther apex, branches ca. 1 mm long, apically expanded. *Capsule* nearly globose to ellipsoid, (10-)14-16(-22) mm long; *seeds* including wing 5-7 × 3.5-5 mm. *Chromosome number* $2n = 30$.

Flowering time : August to November, rarely until December.

DIAGNOSIS AND RELATIONSHIPS : The first of the *Gladiolus* species of Madagascar to be discovered, the strand species *G. luteus* has included until now all of the yellow-flowered species (PERRIER, 1946) from the island except the tiny-flowered *G. bojeri* and *G. perrieri*. There is no doubt that it has been too broadly circumscribed and it is easily distinguished from all other Madagascan species of *Gladiolus* by its membranous, red-brown corm tunics and the many tiny cormlets clustered around the base. The cormlets have a corky tunic and float in water, and corms of *G. luteus* are probably distributed relatively long distances by ocean currents whereas the seeds are likely to be dispersed only locally. The flowers of *G. luteus* are of moderate size and have short perianth tube, shorter than the bracts, and the capsules are relatively large, 10-22 mm long. The other yellow-flowered Madagascan *Gladiolus* species have fibrous corm tunics and produce few or no basal cormlets. The two south coast species, *G. decaryi* and *G. antandroyi*, are distinguished in addition by the longer tubed flowers, the tube exceeding the bracts, and the short, somewhat truncate capsules seldom exceeding 12 mm in length.

DISTRIBUTION AND HABITAT : *Gladiolus luteus* is restricted to the east coast of Madagascar where it extends from Maraontsetra in the north to Mananjary in the south (Fig. 3, *1*). It grows close to the shore, only a few metres above the high water line, either in deep sand or sometimes in rocky situations. It also occurs naturally on Réunion (MARAIS, 1978) where it is found in rocky sites on the south coast and is relatively common in the St. Joseph area. It seems reasonable to assume that the founders of the Réunion populations reached there by water, the small buoyant cormlets being carried there by ocean currents from Madagascar.

MATERIAL EXAMINED. — MADAGASCAR : Tamatave : *Afzelius s.n.*, Tamatave, sandy beach, 2.11.1912 (K); *Baron 6763*, east coast, 8.10. (K); *Boiteau 4092*, Tamatave, 11.1938, fr. (P); *Boivin 6763*, Ile Ste Marie, 1.1849 (K, P); *Bosser & Descoings 189*, Fenerive, dune côtière, 11.1954 (TAN); *Cours 2888*, Ambilo-Lemaitso, dunes bord de mer, 8.10.1946 (K, MO, P, TAN); *Dorr 4475*, beach ca. 5 km S of Ambilo-Lemaitso, 11.12.1985, fr. (MO, P); *Dorr & Barnett 3307*, Foulpointe, plage, 7.12.1984, fl., fr. (K, MO); *4452*, Foulpointe, beach, 6.12.1985, fl., fr. (K, MO, P); *Lam & Meeuse 5560*, Soanierana, sea coast, 30.11.1937, fl., fr. (K, P); *Perrier 8370*, Maroansetra, sables marins, 8.1912 (P); *14108*, Vatomandry, sables littoraux, 9.1921 (K, P); *18298*, Ambilo, bord de la mer, 10.1927 (K, MO, P, TAN); *Rakotozafy 2047*, Foulpointe, sable, bord de la mer, 4.1986 (TAN); *Schlieben 8001*, Tamatave, 2 m, 15.11.1959 (BM, HBG, K, MO, TAN); *Viguier & Humbert 2002*, Andovoranto, 13.12.1912 (P). Fianarantsoa : *Cours 424*, Mananjary, 5.12.1950 (TAN); *Decary 13710*, Mananjary, 21.11.1938, fl., fr. (P). — RÉUNION : St. Joseph, *Cadet s.n.* (STCR). — Without precise locality : Madagascar : *Commerson s.n.*, s.d. (P-JU); *du Petit Thouars s.n.*, "*Gladiolus arenarius*", *s.loc.*, s.d. (P).

3. **Gladiolus horombensis** Goldbl., *sp. nov.* — Fig. 4, *1*.

Plantae 25-50 cm altae, tunicis cormi fibrosis, foliis 3-5, spicis 4-10 florum, bracteis 12-18(-22) mm longis, floribus luteis, tubo perianthii 8-11 mm longo, tepalis inaequalibus, 18-26 mm longis, capsulis 7-9 mm longis.

TYPE : *Goldblatt & Schatz 8989*, Madagascar, Fianarantsoa, Horombe Plateau, 14 km by road SW of Ihosy, rock outcrop west of transmitter tower, 1140 m, 26.4.1989 (holo-, P; iso-, K, MO, NBG, PRE, TAN).

Plants 25-50 cm high. *Corms* 12-20 mm in diam., tunics of pale straw-coloured, medium to fine reticulate fibres. *Leaves* 3-5, at least the lower 2-3 basal, linear, 2.5-5(-6.5) mm wide, about as long as the spike, firm with slightly thickened margins (rarely soft-textured), upper leaves cauline and often becoming bract-like above. *Stem* simple or 1-2 branched. *Spike* 4-10 flowered; *bracts* herbaceous, 12-18(-22) mm long, the inner about two-thirds to nearly as long as the outer. *Flowers* bright yellow fading to greenish in the tube, the lower lateral tepals with faint light brown transverse markings across the midline, intensifying after the style arms

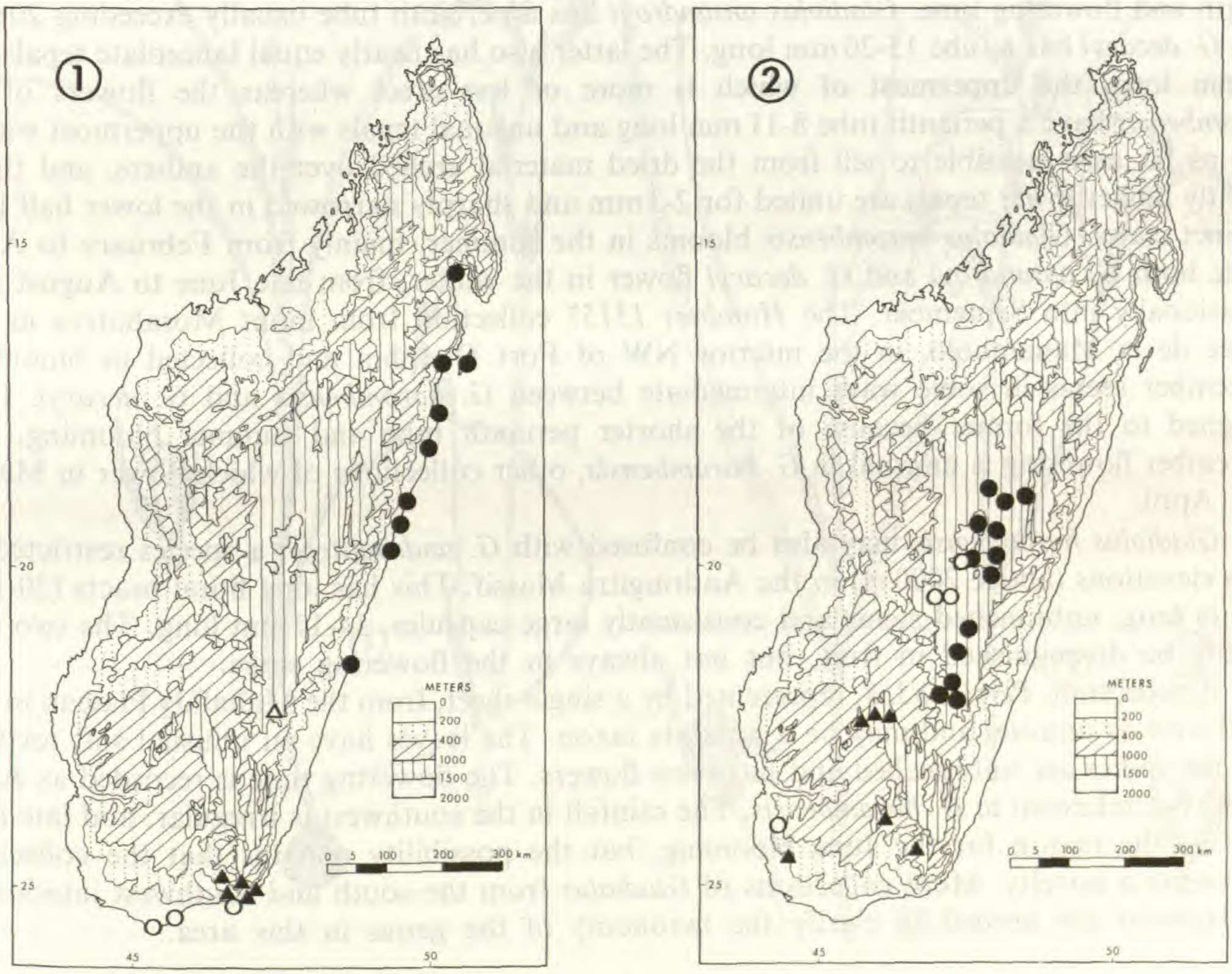


Fig. 3. — **1**, distribution of *Gladiolus andringitrae* (△), *G. luteus* (●) (Réunion not included), *G. decaryi* (▲) and *G. antandroyi* (○); **2**, distribution of *G. horombensis* (▲), *G. perrieri* (○) and *G. bojeri* (●).

unfold; *perianth tube* 8-10 mm long, cylindric below, expanded and curving outwards in the upper 3 mm, the apex exserted from the lower third of the bracts; *tepals* 18-26 mm long, unequal, the upper widest and arching over the stamens, ca. 9 mm wide, narrow at the base and the perianth thus windowed in side view, upper lateral tepals directed forwards and curving outwards in the upper third, the lower three tepals slightly shorter than the uppermost, united below for 3-5 mm, ca. 6 mm wide, narrowed below into claws. *Filaments* 9-12 mm long, inserted at the base of the wider upper part of the tube, unilateral and arcuate, exserted from the tube for 8-10 mm; *anthers* 5-7 mm long, brown with pale green apices. *Ovary* 2-2.5 mm long, style arched over the stamens, white, dividing between the middle and apex of the anthers, branches ca. 2 mm long, usually curving outwards beyond the anthers. *Capsule* (inadequately known) 7-9 mm long, obovoid; *seeds* unknown. *Chromosome number* $2n = 30$.

Flowering time : (December) March to April (rarely until June).

DIAGNOSIS AND RELATIONSHIPS : *Gladiolus horombensis* appears to be closely allied to the south coast species, *G. decaryi* and *G. antandroyi*, with which it shares a similar small capsule, 6-9 mm long in the two specimens known in the early fruiting stage, fibrous corm tunics and relatively short floral bracts. It can usually be distinguished by the differences in perianth tube length and flowering time. *Gladiolus antandroyi* has a perianth tube usually exceeding 20 mm and *G. decaryi* has a tube 15-20 mm long. The latter also has nearly equal lanceolate tepals 18-20 mm long, the uppermost of which is more or less erect whereas the flowers of *G. horombensis* have a perianth tube 8-11 mm long and unequal tepals with the uppermost widest and as far as is possible to tell from the dried material arched over the anthers, and the 3 slightly longer lower tepals are united for 2-3 mm and sharply narrowed in the lower half into distinct claws. *Gladiolus horombensis* blooms in the summer, mainly from February to April while both *G. antandroyi* and *G. decaryi* flower in the winter, from late June to August and occasionally into September. The *Humbert 13157* collection from mont Morahariva in the vallée de la Manambolo, in the interior NW of Fort Dauphin and collected in bloom in December seems in some ways intermediate between *G. horombensis* and *G. decaryi*. It is assigned to the former because of the shorter perianth tube and summer blooming, but December flowering is unusual in *G. horombensis*, other collections of which flower in March and April.

Gladiolus horombensis may also be confused with *G. andringitrae*, a species restricted to high elevations (above 2000 m) in the Andringitra Massif. This has long floral bracts (20-)25-40 mm long, unbranched stems and consistently large capsules, 14-17 mm long. The two can readily be distinguished in fruit, but not always in the flowering stage.

A collection, *Perrier 8358*, represented by a single sheet, from the Mahafaly Plateau in the southwest, is unusual and may be a separate taxon. The leaves have an unusual soft texture, and the spikes are unbranched and have few flowers. The flowering time is recorded as June, otherwise unknown in *G. horombensis*. The rainfall in the southwest is irregular, and late rain may be the reason for the June blooming, but the possibility remains that the collection represents a novelty. More collections of *Gladiolus* from the south and southwest interior of Madagascar are needed to clarify the taxonomy of the genus in this area.

DISTRIBUTION AND HABITAT : *Gladiolus horombensis* is centred in the Horombe Plateau in south-central interior Madagascar (Fig. 3, *2*), where it extends from Ihosy to the Isalo Massif.

There are scattered collections from further south while the single gathering from the Plateau Mahafaly, if correctly placed in this species, represents a significant extension to the west.

MATERIAL EXAMINED. — MADAGASCAR : Fianarantsoa : *Cours 6430*, Ampandrandava, s.d. (MO, TAN); *Jacquemin H310J*, Isalo, Pl. de Horombe, 18.4.1967 (P); *Mabberley 927*, SW of Ihosy, 950-1000 m, 12.4.1971 (K); *Morat 2064*, Horombe, 2.1965 (MO, TAN); *Peltier & Montagnac 3018*, Isalo, 12.4.1961 (P); *Peltier & Peltier 5508*, Isalo, 16.4.1965 (P); *Seyrig 650*, env. d'Ampandrandava, entre Bekily et Tsivory, 1200 m, 4.1943 (P). Tulear : *Humbert 13157*, mont Morahariva, vallée de la Manambolo, aux environs d'Isomonony, 1200 m, 12.1933 (P); *Perrier 8358*, Plateau Mahafaly, près d'Itampolo, 6.1908 (P); *Poisson 505*, entre Andranohinaly et Miary, 16.4.1922 (P).

Fig. 4. — Morphology of **Gladiolus horombensis** (1) and **G. decaryi** (2). Habits and corms × 0.5; capsules full size; seed × 2. (Del. J. C. MANNING).

4. **Gladiolus decaryi** Goldbl., *sp. nov.* — Fig. 4, *2*.

Plantae 15-30 cm altae, tunicis cormi fibrosis, foliis 2-4, spicis 3-5 florum, bracteis 11-15 mm longis, floribus luteis, tubo perianthii 15-20 mm longo bracteas excedente, tepalis inaequalibus, 18-23 mm longis, capsulis 5-9 mm longis.

TYPE : *Decary 10282*, Madagascar, sable, Vinanibe, près de Fort Dauphin, 8.14.1932 (holo-, P ; iso-, BM, K).

Plants 15-30 cm high. *Corms* 8-15 mm in diam., tunics of pale reticulate fibres, the inner layers membranous. *Leaves* 2-4, the lower 2-3 largest and basal, half as long to as long as the stem, uppermost leaf cauline and shorter, more or less linear, 1.5-3 mm wide, sometimes flaccid and more or less falcate. *Stem* erect, usually with 1-2 short branches. *Spike* 3-5 flowered, lateral spike 1-3 flowered ; *bracts* 11-15 mm long, inner slightly shorter to as long as the outer, membranous and pale, becoming dry and light brown from the apex. *Flower* deep yellow, lightly speckled or lined with red towards the base of the lower tepals ; *perianth tube* 15-20 mm long, cylindric and straight below for 14-17 mm, ca. 1 mm wide, expanded in the upper 2-3 mm and curving outwards, extending beyond the bracts ; *tepals* unequal, lanceolate, the upper largest, erect and held apart from the other tepals, 18-20 mm long, 8-9 mm wide, lower 3 tepals united for 1.5-3 mm, narrow and grooved below, 20-23 mm long, nearly horizontal, 5-6 mm at the widest point. *Filaments* ca. 7 mm long, unilateral and arcuate ; *anthers* 4-6 mm long, bluish, pollen orange. *Ovary* ca. 3 mm long, style arched behind the filaments, branching between the middle and apex of the anthers, branches to 3 mm long, recurved, sometimes tangled in the anthers, rarely expanded above. *Capsule* subglobose, 5-9 mm long ; *seeds* including wing 3-4 × 2 mm. *Chromosome number* $2n = 30 + 0\text{-}2B$.

Flowering time : June to early September.

DIAGNOSIS AND RELATIONSHIPS : The large bright yellow, and long-tubed flowers of *Gladiolus decaryi* are its most striking feature. The flower is unusual among the Madagascan species of the genus in having more or less subequal tepals the uppermost of which is upright, and in lacking the usual contrastingly coloured nectar guides on the lower tepals. *Gladiolus decaryi* stands between *G. horombensis* and *G. antandroyi*, having the small capsules of these two species, and a perianth tube intermediate in length between them. The perianth tube of *G. decaryi* is about as long as the bracts or slightly longer whereas the tube of *G. antandroyi* is usually 5-7 mm longer than the bracts.

DISTRIBUTION AND HABITAT : *Gladiolus decaryi* occurs in the southeast of Madagascar (Fig. 3, *1*), where it is restricted to the Tolanaro (Fort Dauphin) district. Recorded habitats include dry prairie, rock outcrops, quartzitic sands, dunes and clearings in littoral forest.

MATERIAL EXAMINED. — MADAGASCAR : Tuléar : *Catat 4314*, env. de Fort Dauphin, s.d. (P) ; *Decary 2854*, Lac Anongy, distr. Ambovombe, 11.6.1924 (P) ; *3160*, Behara, distr. Ambovombe, 3.9.1924 (P) ; *10001*, rocailles gneissiques, Fort Dauphin, 4.7.1932 (P) ; *10054*, Pic St. Louis, 3-400 m, Fort Dauphin, 10.7.1932 (P) ; *10071*, brousse sèche, Ivoro, Fort Dauphin, 11.7.1932 (P) ; *10153*, sable de quartzite, vallée d'Isaka, distr. Fort Dauphin, 27.6.1932 (P) ; *10282*, sable, Vinanibe, près de Fort Dauphin, 14.8.1932 (BM, K, P) ; *10522*, prairie sèche, Evondro, Fort Dauphin, 4.9.1932 (P, PRE) ; *Morat 1313*, baie d'Italy, Fort Dauphin, 7.1965 (MO, TAN) ; *Paroisse 43*, plaines sablonneuses, env. de Fort Dauphin, 1897 (P) ;

Pernet 27, dunes around Fort Dauphin, s.d. (MO, TAN); *Puff 800803-1/5*, sandy soil in openings in coastal dune forest around Fort Dauphin, 3.8.1980 (MO, TAN); *Ramarokoto 2110RN*, Isimailahy, Ranopiso, Fort Dauphin, 8.8.1950 (MO, P, TAN).

5. **Gladiolus antandroyi** Goldbl., *sp. nov.*

Plantae (15-)25-50 cm altae, tunicis cormi fibrosis, foliis 3-5, spicis (2-)4-8 florum, bracteis 15-23 mm longis, florivus luteis, tubo perianthii 20-30 mm longo, tepalis inaequalibus 20-25 mm longis, capsulis 11-14 mm longis.

TYPE : *Humbert & Capuron 29286*, Madagascar, Cap Sainte-Marie, extrême sud (holo-, P; iso-, K, MO, TAN).

Plants (15-)25-50 cm high. *Corms* 12-14 mm in diam., tunics of pale, netted, somewhat clawed fibres. *Leaves* 4-6, the lower 2-3 basal, about as long as the stem, the upper cauline and shorter, narrowly lanceolate, (3-)5-12 mm wide, soft-textured, the margins and midrib lightly thickened. *Stem* erect, with 1-2 branches, occasionally simple. *Spike* (2-)4-8 flowered; *bracts* 15-23 mm long, herbaceous, flushed reddish above, the inner nearly as long to 2 mm shorter than the outer. *Flower* yellow; *perianth tube* (15-)20-30 mm long, usually well exserted from the bracts, cylindric below, expanded in the upper 2-3 mm and curved outwards; *tepals* lanceolate, unequal, the upper arched over the stamens, 20-22 mm long, the lower 3 horizontal, 23-25 mm long, united for 3 mm. *Filaments* unilateral and arcuate, ca. 10 mm long; *anthers* 6-7 mm long, yellowish. *Ovary* ca. 3 mm long, style arched behind the filaments, dividing opposite the middle to upper half of the anthers, the branches ca. 2.5 mm long. *Capsules* 11-14 mm long, ellipsoid to ovoid; *seeds* including the wing ca. 5.5 × 4 mm. *Chromosome number* not known.

Flowering time : March to September.

DIAGNOSIS AND RELATIONSHIPS : Although known from relatively few collections, there seems little doubt that *Gladiolus antandroyi* is distinct from *G. luteus*, in which it was included by PERRIER (1946). At the time of PERRIER's treatment, the species was known from two collections, neither well preserved nor representative. The several additional collections now available confirm the constancy of the comparatively large flower and particularly long perianth tube, usually exceeding 20 mm and well exserted from the bracts. The bracts, measuring 15-23 mm, are also relatively long whereas the capsules are comparatively short, usually about 12 mm long but sometimes to 14 mm. This combination of features, combined with fibrous corm tunics and often quite broad leaves, 10-12 mm wide in the type collection, make the species immediately recognizable. Perhaps most closely related to the southeast coast *G. decaryi, G. antandroyi* has similar short capsules but differs in its longer perianth tube (15-20 mm in *G. decaryi*), larger bracts, more robust habit and broader leaves. The fibrous corm tunics and long perianth tube immediately distinguish it from *G. luteus.*

Gladiolus antandroyi is still inadequately known and the extent of its variability is uncertain. Thus the two collections with a somewhat shorter perianth tube, about 15 mm long and not exserted from the perianth tube, *Geay 6324* and *Grandidier s.n.*, both from Faux Cap, have been included here although they seem intermediate between *G. antandroyi* and the related *G. decaryi* in perianth tube length whereas the shape of the flower with an apparently arched upper tepal are characteristic of *G. antandroyi* rather than *G. decaryi.*

DISTRIBUTION AND HABITAT : *Gladiolus antandroyi* appears to be centred in the extreme south of Madagascar in the vicinity of Tanjona Vohimena (Cap Sainte-Marie) (Fig. 3, *1*) but there are collections from Androhomana, SW of Tolonaro (Fort Dauphin) and Faux Cap (although the identity of the specimens from here is uncertain). It grows in dry rocky limestone terrain close to the coast apparently at elevations not exceeding 50 m. The wide range in the recorded flowering time, from March to September, with most collection made in June is unusual, and possibly represents the irregular pattern of rainfall in this dry southern part of Madagascar.

MATERIAL EXAMINED. — MADAGASCAR : Tuléar : *Cours 5261*, Cap Ste Marie, rocks, 50 m, 23.9.1958 (P); *Decary 4018*, Androhomana, bord de la mer, 20.6.1926 (P); *Geay 6324*, Plateau calcaire du Faux Cap, s.d. (P); *Grandidier s.n.*, Faux Cap, 15.7.1901 (P); *Humbert & Capuron 29286*, Cap Ste Marie, calcareous rocks, 5-7.3.1955 (K, MO, P, TAN); *Ratoto Jean de Dieu 1435RN*, Cap Ste Marie, dry rocky ground, 11.6.1948 (P).

6. **Gladiolus perrieri** Goldbl., *sp. nov.* — Fig. 5, *1*.

Plantae 30-50 cm altae, tunicis cormi fibrosis, foliis 4-5, spicis (2-)3-6 florum, bracteis 9-12(-20) mm longis, floribus zygomorphibus luteis, tubo perianthii ca. 5 mm longo, tepalis inaequalibus 8-10 mm longis, capsulis 8-10 mm longis.

TYPE : *Croat 29837*, Madagascar, Fianarantsoa, Massif de l'Itremo, near Col d'Itremo, 27.1.1975 (holo-, MO; iso-, P).

Plants 30-50 cm high. *Corm* 8-10 mm in diam., tunics of fine, pale, reticulate fibres. *Leaves* 4-5, at least the lower 2 basal or nearly so, linear, 1.5-2 mm wide, about half as long as the spike, firm textured with a raised midrib and lightly thickened margins, the upper 1-2 leaves cauline and often bract-like. *Stem* usually unbranched. *Spike* (2-)3-6 flowered; *bracts* herbaceous, 9-12(-20) mm long, the inner slightly shorter than the outer. *Flowers* zygomorphic, deep yellow, sometimes at least, the lower lateral tepals each with a pale transverse band bordered with purple in the lower midline; *perianth tube* ca. 5 mm long, slightly expanded and curving outwards above; *tepals* unequal, narrowly elliptic, acute, 12-14 mm long, the uppermost largest and more or less horizontal, ca. 7 mm wide, the upper laterals curving outwards, the lower three narrowest, ca. 3 mm wide, held close together and directed downwards. *Filaments* ca. 4 mm long, inserted ca. 1 mm below the mouth of the tube, unilateral and arcuate; *anthers* 3-3.5 mm long, pale yellow. *Ovary* 3-4 mm long, style arching over the stamens, dividing near the apex of the anthers, branches ca. 1.6 mm long. *Capsule* obovoid-ellipsoid, 8-10 mm long, 3-4 mm in diam. at the widest; *seeds* unknown. *Chromosome number* unknown.

Flowering time : Mainly December to February, occasionally as late as April, and recorded out of season in August.

DIAGNOSIS AND RELATIONSHIPS : *Gladiolus perrieri* is a slender, inconspicuous plant with narrow grassy leaves and small pale to intense yellow flowers with tepals 12-14 mm long. Dry specimens have long been confused with the closely allied *G. bojeri* which is similar in vegetative features but the small flowers are pendent and actinomorphic whereas those of *G. perrieri* are zygomorphic and borne on straight spikes. The two species were not distinguished

by either PERRIER (1946) or GOLDBLATT (1982) and it is only as a result of field study of living plants that the two species were recognized as separate taxa. The capsules of *G. perrieri* are 8-10 mm long, and readily distinguished from those of *G. bojeri* which are 14-25 mm long.

DISTRIBUTION AND HABITAT : The range of *Gladiolus perrieri* is almost entirely within that of *G. bojeri* (Fig. 3, *2*). It extends from near Ankazobe in the south of Tananarive Province into Fianarantsoa Province where there are several records from the Massif Itremo. The record from near Lac Manampetsa (*Humbert & Swingle 5323*) is well to the southwest of all other stations but the plants nevertheless seem to belong here. *Gladiolus perrieri* occurs in rocky situations in mountainous areas, generally above 1600 m.

Fig. 5. — Morphology of **Gladiolus perrieri** (**1**) and **G. bojeri** (**2**). Habits × 0.5; single flower × 1.5; capsule × full size; seed × 3. (Del. J. C. MANNING).

MATERIAL EXAMINED. — MADAGASCAR : Fianarantsoa : *Croat 29837*, Massif de l'Itremo, near Col d'Itremo, 27.1.1975 (MO, P); *Decary 13103*, Ambatofinandrahana, 1600-1800 m, 19.2.1938 (P); *13148, ibid.*, 21.2.1938 (P); *Homole 1824*, Rivière Menaloha, Lac Alaotra, 12.2.1944 (P); *Humbert 28270*, montagnes à l'ouest d'Itremo, s.d. (TAN). Tananarive : *Dorr & Rakotozafy 4522*, Mont Ibity (sud), W of Ambohimanjaka, rocky outcrops, 2000 m, 22.12.1985 (K, MO, P); *Perrier 8378*, environs d'Antsirabe, 4.1910 (P). Tuléar : *Humbert & Swingle 5323*, environs du lac Manampetsa (côte sud-ouest), pl. calcaire, près d'Antananandranto, 16-20.8.1928 (P).

7. **Gladiolus bojeri** (Baker) Goldbl. — Fig. 5, *2*.

Ann. Missouri Bot. Gard. 69 : 380 (1982), in part also including *G. perrieri.*
— *Geissorhiza bojeri* BAKER, J. Bot. 14 : 239 (1876); PERRIER, Flore de Madagascar, 45e fam., Iridacées : 18 (1946); R. FOSTER, Contrib. Gray Herb. 135 : 72 (1941).

TYPES : *Bojer s.n.*, Madagascar, Prov. Emirne, Antongona Mts (Antongona) (lecto-, K, designated by GOLDBLATT, 1982; probable isolecto-, P); *Hilsenberg s.n.* (syn-, not seen).

Plants 15-45(-60) cm high. *Corm* 7-12 mm in diam., tunics of fine, pale, reticulate fibres. *Leaves* 3-4(-5), at least the lower 2 basal or nearly so, linear, 1.5-2(-3) mm wide, about half as long as the spike, firm textured with a raised midrib and lightly thickened margins, the upper 1-2 leaves cauline and often bract-like. *Stem* usually simple, occasionally 1-2 branched. *Spike* 1-3(-5) flowered, drooping in bud, becoming straight as the flowers fade; *bracts* herbaceous, 8-10(-12) mm long, the inner slightly shorter than the outer. *Flowers* actinomorphic, campanulate, pale to deep yellow, without markings; *perianth tube* ca. 2 mm long, nearly cylindric, weakly outcurving above; *tepals* subequal, narrowly elliptic, acute, 9-12 mm long, 3 mm at the widest. *Filaments* 2-2.5 mm long, inserted near the base of the tepals, symmetrically disposed; *anthers* nearly 3 mm long, pale yellow. *Ovary* 3.5-4 mm long, style straight, surrounded by the stamens, dividing opposite the upper third of the anthers, branches ca. 1.6 mm long, extending between the anthers. *Capsule* erect, nearly cylindric, obtuse, (14-)17-20(-25) mm long, 3-4.5 mm in diam. at the widest; *seeds* including the wing 3-4 × 1.5-2.5 mm, the wing often poorly developed laterally, yellow-brown. *Chromosome number* $2n = 30$.

Flowering time : Mid November to March, rarely until early April.

DIAGNOSIS AND RELATIONSHIPS : Easily recognized among the species of *Gladiolus* in Madagascar by its slender habit and small, actinomorphic and pendent flowers, *G. bojeri* is also distinct in having unusual long slender capsules. At maturity the capsules are normally at least 17 mm long and thus well exserted from the bracts that seldom exceed 10 mm. The flowers are pale to deep yellow and have a perianth tube ca. 2 mm long and tepals 8-10 mm long. Although not evident in many collections, the flowers are pendent at anthesis, and the spike gradually straightens as the flowers fade so that it is erect when the capsules ripen. The perianth and stamens are perfectly regular in arrangement, with the straight stamens disposed symmetrically around the style which is situated in the centre of the flower. Actinomorphic flowers are rare in *Gladiolus* which typically have medianly zygomorphic flowers with unilateral, arcuate stamens (LEWIS et al., 1972). Actinomorphic flowers in *Gladiolus* are known otherwise in three southern African species that are not directly related to *G. bojeri*. The actinomorphic condition is probably secondary in *G. bojeri*.

Originally assigned to the southern African and Cape genus *Geissorhiza*, most likely because of its small and actinomorphic flower, *Gladiolus bojeri* certainly belongs in *Gladiolus*, with which its reticulate corm tunics, herbaceous bracts, winged seeds, and chromosome number on $n = 15$, accord completely. *Geissorhiza* is distinguished from *Gladiolus* by woody corm tunics, actinomorphic or sometimes declinate flowers, angular (to angular-ridged) seeds and a basic chromosome number of $x = 13$ (GOLDBLATT, 1982, 1985).

Gladiolus bojeri is easily confused when dry with *G. perrieri* which is nearly identical in its vegetative appearance and also has small, yellow flowers. In the latter the flowers are zygomorphic and borne on a secund, erect spike. Also, spikes of *G. perrieri* usually have at least three, and up to six, flowers and the capsules are only 8-10 mm long whereas spikes of *G. bojeri* rarely have more than 2-3 flowers and the capsules are slender and elongate, ranging from 14-25 mm in length. No doubt the two species are closely related, and presumably they share a common ancestor.

DISTRIBUTION AND HABITAT : One of the more widespread of the Madagascan species of *Gladiolus, G. bojeri* extends across the eastern half of the interior plateau from Tananarive and its immediate vicinity in the north to the Andringitra Massif in the south (Fig. 3, *2*). It grows in open grassland, usually in thin or stony soils, and on rock outcrops.

MATERIAL EXAMINED. — MADAGASCAR : Fianarantsoa : *Bosser 1236*, Antanifotsy, 12.1951 (MO, TAN); *Guillaumet 3754*, Andringitra, Plateau d'Andohariana, 13.1.1971 (P); *Humbert 3655*, Massif de l'Andringitra, 27.11-8.12.1924 (P); *Keraudren-Aymonin & Aymonin 25757*, Itremo, bois de tapia, 1.12.1970 (P); *Rakotovao 7284RN*, Ambalavao, Vohitsaoka, 22.1.1955 (P); *9932RN*, Sendzisoa, Ambalavao, 13.1.1958 (P); *Scott Elliot 1854*, foot of Andringitra, s.d. (K); *Schlieben 8191*, Ambalamankana (Fianarantsoa-Ambalavao), 18.12.1959 (TAN). Tananarive : *Benoist 484*, Manjakatompo, 19.12.1950 (P); *1638, ibid.*, 20.12.1951; *Bosser 8851*, Ambohimandroso (Ambatolampy), 12.1955 (MO, TAN); *13738*, près de Tananarive, route du sud, 12.1959 (MO, TAN); *Capuron s.n.*, Fendrehana (E d'Ankaratra), 26.12.1948 (P); *Catat 453*, Sarobaratra (sud de Antsirabe), 3.1889 (P); *1160*, lac Tritriva, 5.1889 (P); *Croat 29016*, Massif de l'Ankaratra, Mankatompo Forest Station, 22.1.1975 (MO, P); *Decary 13834*, Betafo, Vavavato, 29.11.1938 (P); *Dorr et al., 3688*, R.N. 2, east of Carion, rock outcrops, 5.2.1985 (MO); *Hain 15*, near Ilafy, 10 km NE of Tananarive, 10.12.1967 (K); *Leandri 2589*, Antongona, 40 km ouest de Tananarive, 16.1.1960 (P); *Peltier & Peltier 1592*, Talata-Volonondry, près de Tananarive, 11.12.1959 (P, MO, TAN); *1765*, Antongona, 16.1.1960 (P); *1797*, Ambatsetokona près Talata-Volonondry (Tananarive banlieue), 22.1.1960 (P); *1882*, Amboasary (près Ambatolampy), 14.2.1960 (P); *3466*, Andranosoa (près Tananarive), 21.3.1962 (P); *4617*, Manjakatompo, 19.1.1964 (P); *Perrier 8355*, Cime à l'W Ambositra, 12.1911 (P); *Scott Elliot 2092*, Ankaratra, febr. (BM); *Viguier & Humbert 1352*, Vakinankaratra, pentes nord du pic de Vohimalaza près Betafo, vers 1500 m, 18.11.1912 (P); *1698*, Itasy, flanc ouest de l'Ankaratra entre Ambatofotsy et le Tsiafojarona, 19.11.1912 (P); *Waterlot 436*, env. de Tananarive, 1.1912 (P); *1033*, Manjakandriana, Angavo, 12.1928 (P); *s.n.*, Antsirabe, 12.1919 (P). Without precise locality : *Baron 2071, 2854*, central Madagascar, s.d. (K); *Campenon s.n.*, Madagascar, s.d. (P); *Hilsenberg & Bojer s.n.*, in montibus prov. Emerine, s.d. (BM); *Parker s.n.*, Sakoerintany, s.d. (K); *Scott Elliot 1805*, dry hills of the interior, s.d. (K).

8. **Gladiolus dalenii** van Geel. — Fig. 6.

Sert. Bot. fasc. 28 (1829); HILLIARD & BURTT, Notes Roy. Bot. Gard. Edinburgh 37 : 297 (1978). — *Gladiolus garnieri* KLATT, Linnaea 37 : 511 (1872); BAKER, Handbk. Irid. : 214 (1892); PERRIER, Flore de Madagascar, 45e fam., Iridacées : 13 (1946). TYPE : Madagascar, without precise locality, *Garnier 84*, not *86* as publ. (holo-, JE). *Syn. nov.*

— *Gladiolus ignescens* BOJER ex BAKER, J. Bot. 14 : 334 (1876). SYNTYPES : Madagascar, without precise locality, mont. prov. Emerina, *Hilsenberg & Bojer s.n.* (BM); in montib. prov. Emirne, s.d., *Lyall 158* (K); *Pool s.n.*, not located.

Other notable synonyms include *G. quartinianus* A. RICH., from Ethiopia; *G. natalensis* HOOK., *G. psittacinus* HOOK. and *G. dracocephalus* HOOK., all from Natal, South Africa. Additional synonyms, all based on African types, are cited by LEWIS et al., 1972 and GEERINCK, 1972.

TYPE : South Africa, Natal, without precise locality, collector unknown, cultivated in Holland (lecto-, illustration *in* Sert. Bot. fasc. 28, designated by HILLIARD & BURTT, 1978).

Plants 70-110 cm high. *Corm* 15-25 mm in diam., tunics of brittle membranous layers, the outer becoming irregularly broken, rarely subfibrous, reddish-brown. *Leaves* 4-6(-7), at least the lower 3 basal or nearly so, narrowly lanceolate to more or less linear, (4-)5-10(-14) mm wide, about half as long as the spike, firm textured with moderately thickened midrib and lightly thickened margins, the upper 1-2 leaves cauline and sheathing for at least half their length, sometimes entirely, often imbricate. *Stem* simple, 3-5 mm in diam. below the first flower. *Spike* (2-)3-7(-9) flowered; *bracts* herbaceous, 3.5-6 cm long, the inner slightly shorter than the outer. *Flowers* red to orange with the lower three tepals yellow except in the upper third, rarely the perianth entirely yellow; *perianth tube* 30-35 mm long, nearly cylindric and curving outwards in the upper half; *tepals* unequal, all more or less broadly elliptic, the uppermost largest, 35-40 mm long, to 14-22 mm at the widest, the upper laterals ca. 5 mm shorter and 15-20 mm wide, the lower three 20-25 mm long, 7-10 mm wide. *Filaments* ca. 30 mm long, inserted in about the midline of the tube, exserted for ca. 15 mm; *anthers* 12-15 mm long, pale yellow. *Ovary* 6-8 mm long, style arching over the stamens, dividing near the apex of the anthers, branches ca. 3 mm long. *Capsule* ellipsoid to ovoid, 25-35 mm long, 12-14 mm in diam. at the widest; *seeds* including the wing 9-11 × 5-7 mm, the wing uniformly developed around the seed, light brown. *Chromosome number* $2n = 30$ in Madagascar, ca. 45, 60, 90 in Africa.

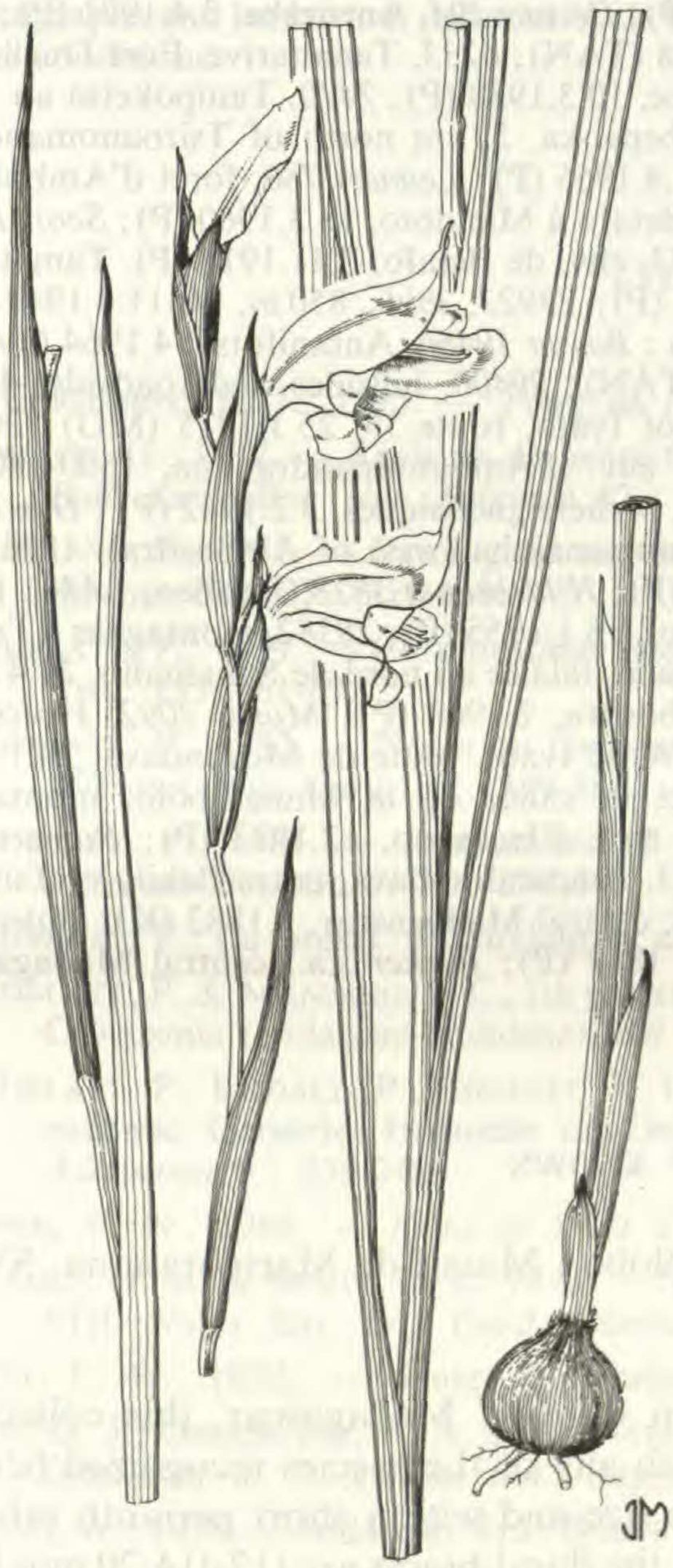
Flowering time : Mid November to April, rarely later but recorded in flower as late as June.

DIAGNOSIS AND RELATIONSHIPS : Immediately recognizable among the species of *Gladiolus* in Madagascar by its robust habit and large, orange-red flowers, *Gladiolus dalenii* is the only species of Madagascan *Gladiolus* not endemic to the island. It is not closely related to the other species of the genus in Madagascar but to a complex of African and largely tropical species characterized by large flowers and bracts and a fan of several, usually broad leaves. Its broad and strongly hooded upper tepal, broad upper laterals and smaller, much narrower, recurved lower tepals, half to a third as the upper, generally robust habit and fan of 5 or more, plane leaves are typical of this complex of African species.

Careful examination of the available collections of this complex from east and southern Africa suggests that *Gladiolus garnieri* is not a distinct species, but falls within the range of variation found in *G. dalenii*. The Madagascan plants appear to be less variable than is the species in tropical Africa, and they consistently have comparatively narrow leaves and fewer flowers per spike than is the norm in Africa. The form of the flowers matches numerous African collections. It seems likely that *G. dalenii* is of fairly recent origin in Madagascar, hence its limited variability.

There is a large number of synonyms for *Gladiolus dalenii*. Some of those from tropical Africa have been dealt with by GEERINCK (1972) in his treatment of the genus in Zaire and have not been systematically reviewed here. The species is treated as *G. psittacinus* in Flora of West Tropical Africa (HEPPER, 1968) who listed the synonyms based on West African types. The southern African synonyms were treated by LEWIS et al. (1972) who used the name *G. natalensis* for *G. dalenii*. The reasons for the use of the name *G. dalenii* have been discussed by HILLIARD & BURTT (1978).

DISTRIBUTION AND HABITAT : *Gladiolus dalenii* has been collected widely across the wetter parts of the interior plateau of Madagascar except for the northern third of the island (Fig. 6).



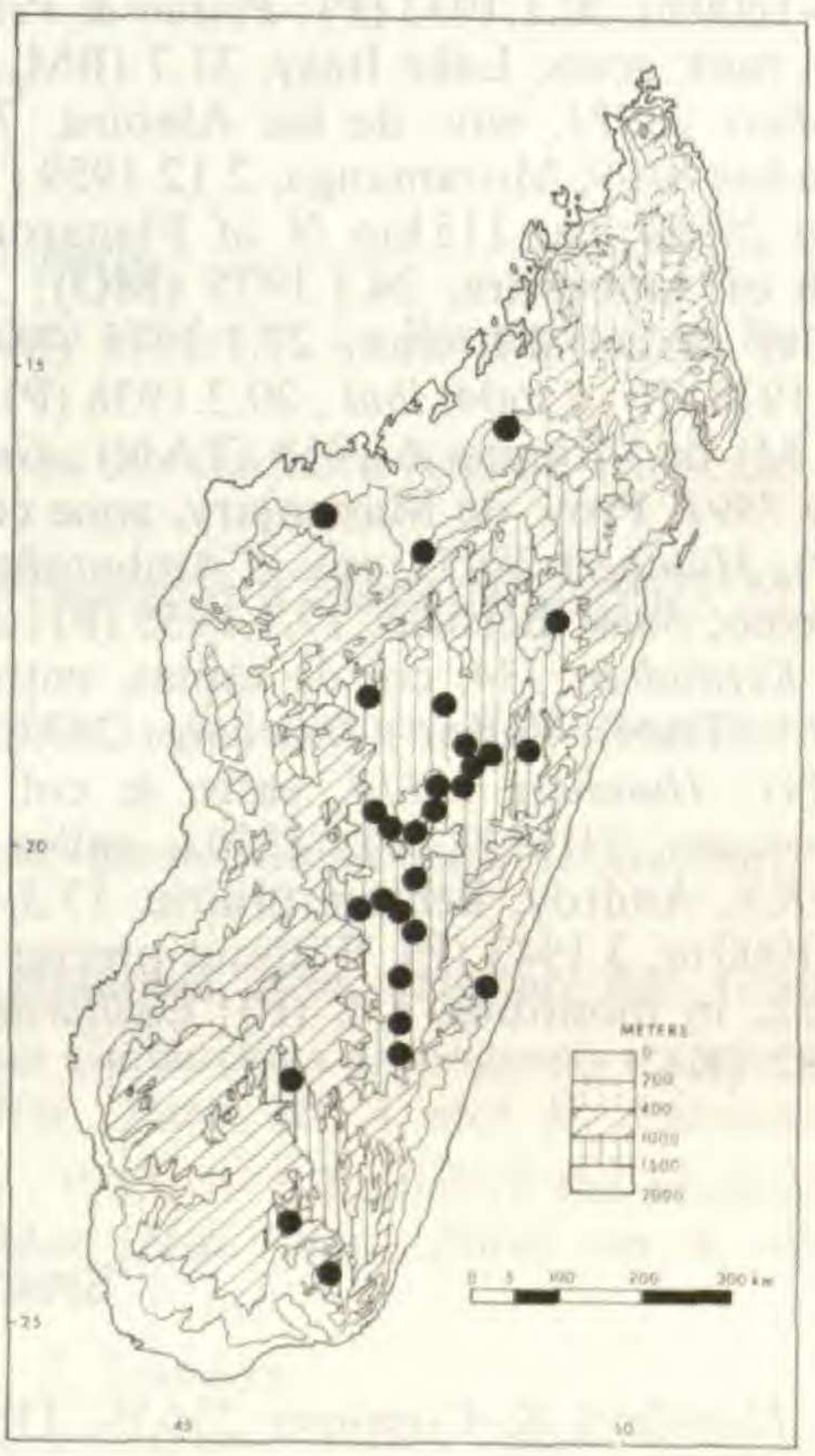


Fig. 6. — Morphology and distribution in Madagascar of **Gladiolus dalenii**. Habit, flowers and corm × 0.5. (Del. J. C. MANNING).

The range extends from Lake Alaotra in the northeast and the Majunga area in the west to the southern edge of the plateau, inland from Fort Dauphin. Records indicate that it occurs in dry to wet grassland, and occasionally in marshy situations.

Outside Madagascar, *Gladiolus dalenii* has a distribution extending from Natal in eastern South Africa through south tropical and East Africa to northern Ethiopia, and west through the Sudan and Central African Republic to Senegal and Guinea. It is perhaps the most common species of *Gladiolus* and occurs most frequently in mesic grassland and savanna.

MATERIAL EXAMINED. — MADAGASCAR : Majunga : *Heydel s.n.*, "Tsaratana", région de Majunga (? = Tsaratanana east of Boriziny), 10.11.1933 (P); *Perrier 526*, Maevatanana, 3.1898, fl. & fr. (P); *8356*, Behena sur la Hopy, 1200-1400 m, 6.1911 (P). Tananarive : *Benoist s.n.*, dry slopes and paddies, 11 km south of Tananarive, 30.3.1951 (P); *Bosser 714*, Manjakandriana, 4.1951 (TAN); *15308*, Angavokely, 4.1961 (TAN); *Catat 245*, Ankaratra, 1600 m, 1.5.1889, fr. (P); *Decary 294*, Antsirabe, 3.4.1921 (P); *296, 299*, Tananarive, 3.4.1921 (P); *6202*, Ambohimanga, 1.4.1928 (TAN); *6233*, Tananarive, Fort Duchesne, 8.4.1928 (P, TAN); *7333*, Massif de l'Angavo, près Ankazobe, 10.3.1930 (P); *7410*, Tampoketsa au nord d'Ankazobe, 11.3.1930 (P); *Barnett et al. 283*, near Bory-bepaoka, 52 km north of Tsiroanomandidy, 10.1.1985 (MO); *Humbert 30322*, Massif de l'Ankaratra, 27.4.1955 (P); *Leandri 780*, forêt d'Ambohiby, 1400-1600 m, 30.1.1933 (P); *Peltier & Peltier 2047*, route de Betafo à Mandoto, 18.3.1960 (P); *Scott Elliot 1922*, rank grass, Lake Itasy, 31.7 (BM, K, P); *Ungemach 53*, env. de Betafo, 3.11.1915 (P). Tamatave : *Humbert 23921*, env. de lac Alaotra, 750 m, 10-11.4.1949 (P); *23922, ibid.*, 850 m, 10-11.4.1949 (P); *Schlieben 8109*, Moramanga, 2.12.1959 (TAN). Fianarantsoa : *Bosser 19466*, Antanifotsy, 4.1964 (TAN); *Croat 29984*, ca. 115 km N of Fianaroantsoa, 28.1.1975 (TAN); *29400*, hillsides and roadside, 45 km north of Ambositra, 24.1.1975 (MO); *29570*, 10 km west of Ivato, route 35, 25.1.1975 (MO); *29887*, vicinity of col d'Itremo, 27.1.1975 (MO); *Decary 12907*, env. d'Ambatofinandrahana, 1600-1800 m, 15.2.1938 (P); *13604, ibid.*, 20.2.1938 (P); *17303*, Ambositra, rochers gneissiques, 3.2.1942 (P); *Descoings 965*, Mt de l'Itremo, 6.1955 (TAN); *Grandidier s.n.*, Ambatomenaloha (west of Ambositra), 1876 (P); *Geay 7891*, Prov. de Mananjary, zone côtière, 3.4.1909, fr. (P); *Hildebrandt 3878*, Betsileo, 1.1881 (BM, K, P); *Humbert 28053*, env. d'Ambatofinandrahana (Betsileo), 16.1.1955 (P); *28382*, montagnes à l'ouest d'Itremo, ouest Betsileo, 17.1.1955 (P); *Jacquemin H335J*, Isalo, falaise au nord de Sakamalio, 21.4.1967 (P); *Keraudren 134*, col de tapias, entre Antsirabe et Ambositra, 2.1960 (P); *Morat 2092*, Horombe, 2.1965 (TAN). Tuléar : *Descoings 2033*, bois de Faliarivo, W de Ivato, route de Morondava, 24.1.1957 (TAN); *Humbert 12114*, entre le col du Kalambatitre et la vallée de la Manambolo, montagnes gneissiques, 11.1933 (P); *13201*, vallée de la Manambolo env. d'Isomono, 12.1933 (P); *Ramorokoto 5048RN*, Androy, Behara, prairie, 17.3.1953 (P); *Seyrig 393*, Ampandrandava, entre Bekily et Tsivory, 700-1000 m, 3.1943 (P). Without precise locality : *Baron 888*, central Madagascar, 1.1882 (K); *Bojer s.n.*, Imirne, in montibus, s.d. (P); *Gaillardot 84*, Madagascar, 1869 (P); *Parker s.n.*, central Madagascar, 2.1882 (K).

SPECIES INCOMPLETELY KNOWN

Humbert & Capuron 25650, Diego Suarez, Ambilobe : Massif de Marivorahona, SW of Manambato, 3.1951 (MO, P).

The only record of *Gladiolus* from the northern third of Madagascar, this collection, represented by several duplicates, does not accord with any of the species recognized here. It has a slender spike of 2-4 yellow flowers of moderate size and with a short perianth tube ca. 6 mm long. The capsules are large, 15-18 mm long and the floral bracts are (12-)14-20 mm long, the median range for bracts in the yellow-flowered Madagascan *Gladiolus* species, to which group it undoubtedly belongs. The plants accord best with *G. horombensis* but this species has

a branched flowering stem and relatively large flowers, and notably small capsules, 6-9 mm long, at least so far as is known.

Better preserved flowers, or live material are needed to determine floral details, and additional collections would be helpful in assessing the range of variation the prevails in this possible new species.

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Pollen characters of the *Polyalthia hypoleuca* complex (*Annonaceae*) : their significance in establishing monophyly and candidate outgroups

S. H. Rogstad & A. Le Thomas

Summary : Pollen from all members of the *Polyalthia hypoleuca* complex (*Annonaceae*) of Malesia was examined and found to be homogeneous within the complex. Using SEM analyses, all members have pollen with solitary grains that are monosulcate, heteropolar, " boat-shaped ", with a psilate tectum having medium sized perforations. From TEM analyses, pollen wall features include an exine with short, stout, and regular columellae, and a bipartite basal layer with a thick outer layer connecting the bases of the columellae, and an inner layer of discontinuous lamellar foliations. These pollen characters are added to the suite of characters delimiting the *P. hypoleuca* complex, and the suite is used to seek the most plausible outgroup for the complex. It is concluded that the best candidates for taxa with the most immediate phylogenetic proximity to the complex are : 1) from within the genus, two species from Madagascar ; or 2) considering other genera, the Neotropical genus *Pseudoxandra*.

Résumé : Toutes les espèces du complexe *Polyalthia hypoleuca* (Annonacées de Malaisie) ont un type pollinique homogène. Au MeB, le pollen est simple, monosulqué, hétéropolaire, à tectum lisse perforé. Les coupes de l'exine au MeT, montrent un tectum extrêmement massif, des columelles courtes et très régulières et une couche basale ectexinique bipartite, continue et épaisse dans sa partie superficielle où elle relie la base des columelles, constituée de feuillets lamellaires discontinus dans sa partie profonde. Ajoutés à l'ensemble des caractères morphologiques qui délimitent le complexe *P. hypoleuca*, ces caractères polliniques sont utilisés pour rechercher le groupe externe le plus plausible de ce complexe. Il apparaît que les taxons les plus proches sont : 1) deux espèces malgaches au sein du genre *Polyalthia* ; ou 2) au niveau générique, le genre néotropical *Pseudoxandra*.

Steven H. Rogstad, Department of Biology, Washington University, St Louis, Missouri, U.S.A. 63130.
Annick Le Thomas, Laboratoire de Phytomorphologie de l'E.P.H.E., Muséum National d'Histoire Naturelle, 16, rue Buffon, 75005 Paris, France..

The *Annonaceae* (approximately 2300 species) is the largest family of the Magnoliales (*sensu* Cronquist, 1981) including nearly 80 % of the species of the order. Even in that wider constellation of taxa, the so-called " ranalean complex " of 33 families grouped on the basis of their possession of putative primitive angiosperm characters (Walker, 1976), the *Annonaceae* are approached in size only by *Lauraceae* and *Piperaceae* (both with ca. 2000 species). While the family limits are well defined, the diversification of the large number of species has produced a commensurate diversity of form. This is reflected in the pollen characters of the *Annonaceae*, which are the most diverse for any of the families of the ranalean complex (Walker, 1976).